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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/712,945	11/13/2003	Jae Suk Lee	20059/PIA30962	9550

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EXAMINER	
ARENA, ANDREW OWENS	
ART UNIT	**PAPER NUMBER**
2811	

DATE MAILED: 06/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/712,945	LEE, JAE SUK	
	Examiner	Art Unit	
	Andrew O. Arena	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Stacked hybrid metal line structures including aluminum-copper alloy.

Claim Objections

2. Claims 17-19 are objected to because of the following informalities: use of abbreviations. A full spelling should precede abbreviated terms. For example, "USG" should be replaced by "undoped silicate glass (USG)". Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 13-15 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. The term "desired" in claims 13 and 15 is a relative term which renders the claim indefinite. The term "desired" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The claims should read "...about 50% of the thickness of the metal line structure" instead.

6. Claim 14 reads "a metal line structure as defined in claim 12, wherein the first metal lines comprises an Al alloy containing 5% or less." It is unclear from the claims what material comprises the 5% or less, rendering the claim indefinite.

7. Claim 19 includes the recitation "deposited by a PECVD SiOC." It is unclear what sets this apart from the "PECVD" process of the preceding claim. It is further unclear what a PECVD SiOC process is.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 12, 13, 15, 16, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Anand (US 6,500,748), hereinafter Anand.

9. Regarding claim 12, Anand discloses, in Fig. 7, a metal line structure (col 1 ln 10) formed in a semiconductor device (col 1 ln 9), comprising:

first metal lines (17a&b; col 6 ln 28-29) formed on a substrate (11; col 6 ln 8), the first metal lines having a first barrier metal layer (17a; col 6 ln 23) and a first conductive layer (17b; col 6 ln 25-26);

a first interlayer insulator (15, 24, 25; col 6 ln 12-13, 18) between adjacent ones of the first metal lines;

second metal lines (20a&b; col 6 ln 50-52) formed on respective ones of the first metal lines, the second metal lines having a second barrier metal layer (20a; col 6 ln 46) and a second conductive layer (20b; col 6 ln 48-49); and

a second interlayer insulator (18, 26, 27; col 6 ln 36-37, 40) between adjacent ones of the second metal lines.

10. Regarding claim 13, Anand discloses, in Fig. 7, a metal line structure as defined in claim 12, wherein each of the first metal lines (17a&b) has about 50% of the thickness of the metal line structure.

11. Regarding claim 15, Anand discloses, in Fig. 7, a metal line structure as defined in claim 12, wherein the second interlayer insulator (18+26+27) has about 50% of the thickness of the desired metal line structure.

12. Regarding claim 16, Anand discloses a metal line structure as defined in claim 12, wherein the second conductive layer comprises Cu (col 8 ln 66-67).

13. Regarding claim 20, Anand discloses a metal line structure as defined in claim 12, wherein the first and the second barrier metal layers comprise at least one of Ti, TiN (col 7 ln 60-62; col 8 ln 60-62).

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of Iwasaki et al. (US 6,856,021), hereinafter Iwasaki.

16. Regarding claim 14, Anand discloses "a metal line structure as defined in claim 12, wherein the first metal lines comprises an Al alloy" and discloses an alloy of Al and Cu (col 7 ln 66-67), but does not disclose "containing 5% or less." It can be understood by reading the specification that this quotation is meant to read "containing 5% or less of copper." Iwasaki discloses a structure analogous to the present invention (Fig. 1), including main conductors (17,23) composed of an Al-Cu alloy (col 4 ln 3-7), containing 5% or less of copper (col 5 ln 2-3).

17. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the Al-Cu alloy of Iwasaki in the first metal line of Anand, for at least the purpose of enhancing the migration resistance (Iwasaki col 5 ln 1-2).

18. Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of reference U (on 892; see pg 2, 9:30AM N5.4,"Thermal stability study of the interconnect system with fluorinated silicate glass as IMD layers", esp ln 1-4), hereinafter U.

19. Regarding claim 17, Anand discloses "a metal line structure as defined in claim 12, wherein the first interlayer insulator is made of" and suggests a silicate glass (col 7 ln 19-20), but does not disclose "USG or FSG deposited by an HDP process." U is directed toward the same field of endeavor, namely, silicate glasses used as inter-metal dielectrics (IMD), and teaches the advantages of using FSG as an IMD.

taught by U as the silicate glass suggested by Anand; for at least the purpose of enhancing device reliability due to thermal stability of FSG (U line 3-4).

21. Further regarding claim 17, which is considered a product-by-process claim, the limitation "deposited by an HDP process" has not been given patentable weight. The case law establishing this precedent follows:

> "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

22. Regarding claim 18, Anand discloses a metal line structure as defined in claim 12, wherein the second interlayer insulator is made of" and suggests a silicate glass (col 7 ln 19-20), but does not disclose "USG or FSG deposited by a PECVD process." U is directed toward the same field of endeavor, namely, silicate glasses used as inter-metal dielectrics (IMD), and teaches the advantages of using FSG as an IMD.

23. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Anand by using fluorinated silicate glass (FSG) as taught by U as the silicate glass suggested by Anand; for at least the purpose of enhancing device reliability due to thermal stability of FSG (U line 3-4).

24. Further regarding claim 18, which is considered a product-by-process claim, the limitation "deposited by a PECVD process" has not been given patentable weight. The case law establishing this precedent follows:

> "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

25. Regarding claim 19, Anand discloses "a metal line structure as defined in claim 12, wherein the second interlayer insulator is made of" and suggests a silicate glass (col 7 ln 19-20), but does not disclose "USG or FSG deposited by a PECVD SiOC." U is directed toward the same field of endeavor, namely, silicate glasses used as inter-metal dielectrics (IMD), and teaches the advantages of using FSG as an IMD.

26. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Anand by using fluorinated silicate glass (FSG) as taught by U as the silicate glass suggested by Anand; for at least the purpose of enhancing device reliability due to thermal stability of FSG (U line 3-4).

27. Further regarding claim 19, which is considered a product-by-process claim, the limitation "deposited by a PECVD SiOC" has not been given patentable weight. The case law establishing this precedent follows:

> "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew O. Arena whose telephone number is (571) 272-5976. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Steven Loke
Primary Examiner
Steven Loke